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M13501X

NORTHEAST ELECTRONICS

A DIVISION OF NORTHERN TELECOM, INC.

INSTRUCTION MANUAL

MODEL TTS-39BAE
REFERENCE TONE GENERATOR

No. A0039-25-600 ISSUE 1 DATE DEC 1966

PRINTED IN U.S.A.

Airport Rd., Concord, N.H. 03301 • (603) 224-6511 • TELEX 94-3453

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2.5C-0039-0176

NORTHEAST ELECTRONICS CORPORATION
Airport Road
Concord, New Hampshire

MODEL TTS 39BAE REFERENCE TONE GENERATOR

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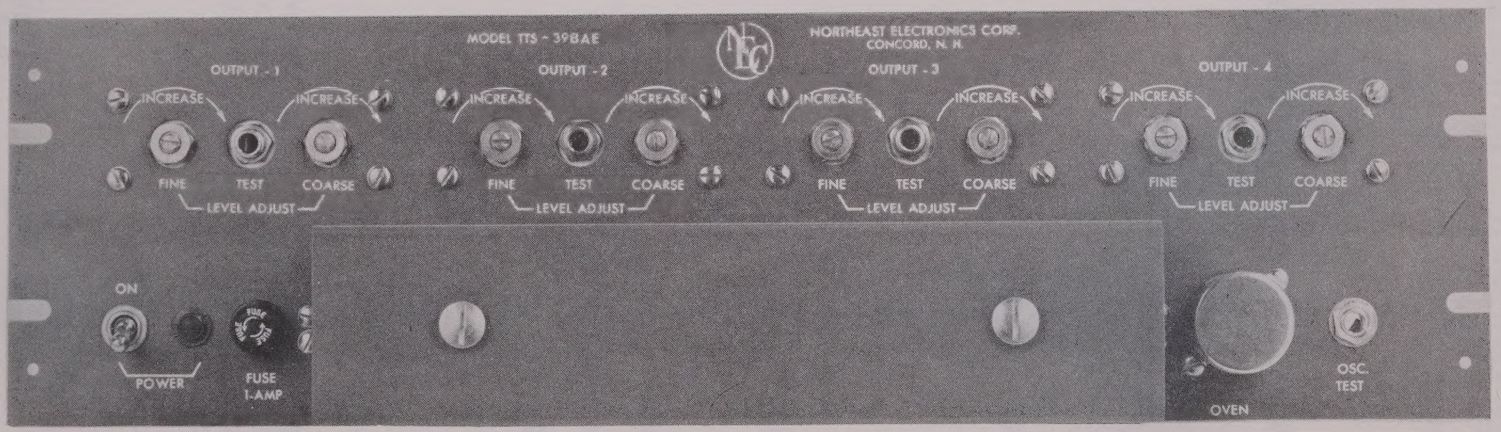
Issued December 1966
Printed in U. S. A.


MODEL TTS - 398AE
NORTHEAST ELECTRONICS CORP.
CONCORD, N. H.
OUTPUT - 1
OUTPUT - 2
OUTPUT - 3
OUTPUT - 4
INCREASE
INCREASE
FINE
TEST
COARSE
LEVEL ADJUST
ON
POWER
FUSE
1-AMP
OVEN
OSC.
TEST

MODEL TTS 39BAE

REFERENCE TONE GENERATOR

OPERATING INSTRUCTIONS

1.0 GENERAL

1.01 The Model TTS 39BAE Reference Tone Generator consists of a basic unit which includes a transistorized oscillator delivering a constant output level. Four independent output modules, designated as Model TTS 39XA, are also supplied. One of these output units, designated as output #4, has been arranged to provide on hook-off hook cycling, i.e., 10 seconds off hook and one second on hook. All four output circuits have been strapped at the factory to provide an output impedance of 900 ohms.

1.02 The output stages are completely independent of one another; trouble in one output stage has no effect on the other outputs. No damage will result if ringing voltage is applied to an output.

1.03 The Model TTS 39BAE is also equipped with a time cycle generator, which provides a ground contact at regular time intervals for the purpose of on hook-off hook cycling of the #4 output circuit.

1.04 Each Model TTS 39XA Output Amplifier Module is provided with a test jack to monitor the output level. The insertion of a test cord in these jacks disconnects the output from the connector appearance.

2.0 PERFORMANCE DATA

2.01 Because of the basic temperature sensitivity of semiconductors, the following specifications are intentionally conservative. Representative sets show substantially better performance than that specified. In most installations the temperature variations are relatively small; consequently, the variations in performance are very small.

Output Frequency: 1000 cps

Frequency Tolerance: ±1%

Harmonic Distortion

Temperature:	50° to 110°F	not more than 1.0%
	30° to 120°F	not more than 2.0%

Output Level:	Nominal	0 dbm
	Maximum	+2.0 dbm
	Minimum	-1.0 dbm

Output Level Variations

Temperature:	50° to 110°F	not more than 0.10 db
	30° to 120°F	not more than 0.20 db
Voltage:	42 - 50 volts	not more than 0.05 db

Current Drain: Max 500 MA

Size: 5 1/4" x 19"

3.0 CIRCUIT DESCRIPTION

Basic Panel

3.01 The schematic diagram to which the following description applies is shown in Figure 1.

3.02 The Model TTS 39BAE basic panel contains the terminals, wiring, oscillator, and associated circuitry necessary to accommodate four Model TTS 39XA Output Amplifier Modules.

3.03 Common fusing, power switching, and reverse voltage protection are supplied by fuse F1, power switch S1, and diode CR 1. A "power on" indication is supplied by pilot lamp PL1.

3.04 Voltage division for the level stabilizing oven unit is supplied by resistor R31. Capacitor C1 provides spark suppression for the thermostat switching contacts located within the oven unit. The DC voltage at pin 3 of the oven should read 24 volts when heating.

3.05 Decoupling between the battery supply and the tone generator is supplied by resistor R35 and capacitor C2. Resistors R32 and R34 and capacitor C3 provide voltage division and filtering for the oscillator amplifier unit.

3.06 The OSC TEST jack provides access to the output of the oscillator amplifier unit.

CAUTION: Damage to the thermistor within the oven unit may result, should high AC or DC voltages be applied to the OSC TEST jack.

3.07 DC blocking between the output of the oscillator amplifier unit and an external Model TTS 39D Distribution Amplifier Panel (optional) is provided by capacitor C4. This circuit is extended to terminal 12 of terminal board TB1.

3.08 Terminals A through G of terminal board TB1 provide the internal connections to the TTS 39XA Output Amplifier Modules. These connections include battery, ground, signal input, and control circuits.

Oscillator Amplifier Circuit

3.09 The circuit diagram to which the following description applies is shown in Figure 2. A component placement diagram is shown in Figure 2A.

3.10 A bridged-T type of R-C oscillator, consisting of three transistor stages, is used. The first two transistors are directly

coupled from the collector of Q1 to the base of Q2. The positive feedback path is completed from the emitter of Q2 back through a blocking condenser and a tungsten lamp, utilized for level stabilization, to the emitter of Q1. A part of the emitter resistance of Q1 has been made variable to allow setting the correct amount of positive feedback necessary for stable operation.

3.11 A negative feedback which is greater than the positive feedback is supplied to the base of Q1 through a null selective network and an emitter follower. At its tuned frequency the selective bridged-T null network decreases the negative feedback sufficiently to permit oscillation to occur at the desired frequency, which is determined by the R-C values employed within the network. This frequency determining network consists of two padded capacitances, C4 and C5, and two selected resistors.

3.12 Amplifier stage Q4 and the cascaded emitter follower stages, Q5 and Q6, provide the necessary voltage and current gain required to drive the thermistor Tx, located within the special oven, onto its voltage maximum or "hump." The output level of the amplifier stage driving the thermistor is determined by the setting of potentiometer R19. Capacitor C7 provides DC blocking between the output emitter follower Q6 and the thermistor.

Output Amplifier

3.13 The TTS 39XA Output Amplifier Module consists of an input attenuator, a highly stabilized buffer amplifier, and one emitter follower stage coupled to an output transformer providing a balanced output. These units can be strapped in the field for either 600 or 900 ohm operation. Output levels are adjustable over a range from -1 dbm to +2 dbm. The circuit diagram to which the following description applies is shown in Figure 3. A component location diagram is shown in Figure 3A.

3.14 The input from the common oscillator unit is coupled to the Q1 buffer amplifier stage through the attenuator circuit, consisting of potentiometers R4 and R14 and fixed resistors R1, R5, and R14A. These controls provide the COARSE and FINE adjustment of the output level. Capacitor C1 provides DC blocking for the base circuit of Q1. The output of the Q1 buffer amplifier stage appears across collector load resistor R3 and in turn is DC coupled to emitter follower stage Q2. The signal voltage appearing across the R13 emitter load resistor of transistor Q2 is coupled to output transformer T1 through DC blocking capacitor C2. Precision resistors R8 and R9 provide the impedance buildout for either 600 or 900 ohm operation. The 600 ohm condition exists when resistor R9 is strapped out of the circuit over terminals marked Z. Capacitor C3 provides DC blocking for the output circuit. Capacitor C5 eliminates any possibility of high frequency oscillations.

3.15 The output of transformer T1 is coupled to terminals 1 and 2 of the terminal board located on the rear of the module. This circuit is carried over contacts of the test jack. When plugged into the test jack, all external circuits are disconnected by the interrupter springs of the test jack.

3.16 Resistors R10 and R11 and capacitor C4 provide voltage division and filtering for the output amplifier circuit. Resistor R12 serves as the sleeve resistance to battery for the external circuit connected to the module.

Time Cycle Generator

3.17 The Model TTS 39BAE also contains a time cycle generator as standard equipment. This unit provides the time base for the cycling of ON and OFF HOOK supervision provided on the #4 output module.

3.18 Start ground for the time cycle generator is derived through an isolating diode from the sleeve circuit of the #4 output amplifier module.

3.19 A schematic diagram of the time cycle generator circuit is shown in Figure 4. A component placement diagram is shown in Figure 4A. The operation of the time cycle generator is as follows:

3.20 When ground is applied to start lead S of the generator circuit, capacitor C1 in the base circuit of transistor Q1 will charge over the break contacts of relay K2 and resistor R6 to the regulated voltage appearing at the junction of R1 and zener diode CR2. Relay K1, which is in the emitter circuit of Q1, will operate when the base voltage of Q1 has risen to approximately 8 volts. The selected value of R6 determines the rise time and is selected to produce a time constant of 1 second. Relay K1, when operated, interrupts the ground circuit to terminal G over its make contacts 4 and 5. Terminal G is part of TB1 of the basic panel shown in Figure 1.

3.21 K1, operated, also energizes relay K2. Relay K2, when operated, interrupts the charging circuit from battery via R6 to C1 and establishes a circuit from ground through R5, its make contacts 3 and 4, to capacitor C1, which will slowly discharge capacitor C1. The time required to discharge C1 is determined by the selected value of R5. R5 has been selected to provide a discharging time constant of 10 seconds. After C1 has discharged sufficiently to allow K1 to release, ground is again applied to terminal G and the charging circuit for C1 re-established.

3.22 Relay K1, while released, causes relay INT (located on the #4 output module) to operate. INT, while operated, opens the RING circuit to the circuit connected to the #4 output module. Thus, while INT is operated, an on hook condition is established.

4.0 CONTROLS AND ADJUSTMENTS

4.01 The following controls and jacks appear on the front panel of the TTS 39BAE:

a. POWER switch and indicator lamp.

b. OSC TEST - monitor oscillator.

c. TEST jack for TTS 39XA Output Amplifier Modules.

d. COARSE level adjustment (locking) for TTS 39XA Output Amplifier Modules.

e. FINE level adjustment (locking) for TTS 39XA Output Amplifier Modules.

4.02 It is necessary to allow at least a half hour warm up period before any level adjustments are made. This amount of time is required for the temperature controlled oven containing the level stabilization element to reach its operating temperature. Normal output for units which have been adjusted for 0 dbm output will be in the order of +2.5 dbm when first turned on. This will decrease and stabilize at 0 dbm when the oven reaches its operating temperature. Level adjustments can be made with the COARSE and FINE adjustment, but this adjustment is to be made only after the oven has reached its operating temperature.

5.0 MAINTENANCE

5.01 Apart form occasional checks on the output levels, the TTS 39BAE units do not require any routine maintenance.

5.02 If any abnormal operation occurs, it can easily be traced to one of the three groups of circuits. These circuits are as follows:

a. Oscillator and thermistor driving circuit.

b. Output amplifier circuits.

c. Time cycle generator circuit.

5.03 When there is no output at any of the output amplifiers, the trouble is most likely to be located in the oscillator and thermistor driving circuits, and trouble shooting should be conducted as follows:

a. Referring to Figure 2A, connect the high side of a VTVM to point A and the low side to the low side of resistor R90 (ground) on the oscillator board. The voltage should be 1.5 volts RMS at these points. If it is not, adjust R15 for this level. Turning R15 with a screwdriver clockwise increases the positive feedback and therefore increases the output level appearing at point A. There should be no fluctuation of the signal level at this point once the level is adjusted to 1.5 volts RMS.

b. If there is no voltage between point A and ground (with R15 in maximum clockwise position), check the filament of the tungsten lamp for continuity. Replace if faulty. If the lamp is good, replace the transistors, starting with Q1 and ending with Q3. If trouble still prevails, check for proper DC voltage as indicated on the schematic diagram of the circuit. These voltages should be within ±10% as indicated.

c. When the preceding steps fail to produce an output at point A, check other components contained in the oscillator circuit, such as resistors, capacitors, and the frequency switching relays. It is important after correction of the trouble to readjust the voltage appearing at point A and ground to 1.5 volts RMS.

5.04 With the oscillator operating properly, check the RMS voltage appearing between pins 2 and 7-8 of the oven. This voltage should be in the order of 1.1 volts RMS; the exact voltage depends upon the characteristics of the individual thermistor within the

oven itself. The oven must be at normal operating temperature for this measurement. If no voltage appears at pin 2 of the oven, check the thermistor driving portion of the circuit. This circuit consists of transistors Q4, Q5, and Q6 and their associated circuitry. After this circuit has been restored to normal operating condition, check the operating point of the thermistor. This is covered under Thermistor Operating Level Adjustment.

5.05 If the voltage appearing across the thermistor (between pins 2 and 7 of the oven) is found to be excessive, check the thermistor for continuity, as this indicates an open thermistor. If the thermistor is found to be defective, installation of a new oven unit is recommended.

Thermistor Operating Level Adjustment

5.06 The thermistor driving voltage has been factory adjusted and should require further adjustment only when replacement of the oven unit has become necessary. For this adjustment the oven must be at its normal operating temperature and the oscillator voltage appearing at the emitter of Q2 should be 1.5 volts RMS. Refer to Figure 2A for the preceding component locations.

5.07 To perform the thermistor level adjustment, remove the protective front cover and connect the high side of a VTVM to the emitter of Q6 (2N1136A) and the low side to ground. Connect an output level meter, such as a Model TTS 4AN or equivalent, into one end of the test jacks. Advance adjustable resistor R19 (located on the oscillator board) to a full clockwise position. Observe the output level and very slowly rotate R19 in a counter clockwise direction to a point where the output level no longer continues to rise as R19 is turned. If necessary, repeat the preceding operation in order to definitely establish this point. The thermistor is now being driven to the beginning of its so called "hump." Observe the VTVM, which should now show a reading of approximately 4 to 5 volts RMS (the exact voltage depends on the characteristics of the individual thermistor), and further rotate R19 to a position that increases the VTVM reading by 1 volt.

Output Amplifier

5.08 When one output circuit is inoperative and the others are functioning normally, it can be assumed that the preceding oscillator and thermistor driving circuit is operating satisfactorily. Trouble shooting should be conducted on the inoperative output stage as follows:

a. With reference to Figure 3A, substitute transistors Q1 and Q2, then recheck for output. If trouble still exists, advance both output level controls (COARSE

and FINE) to their full clockwise position. With the unit on, check the DC voltage at the negative end of capacitor C4; it should read 24 volts DC ±10%. Connect the high side of a VTVM to the junction of R2 and R6 (base of Q1) and the low side to ground. The AC signal voltage at this point should be in the order of .5 volts RMS. If it is not, trouble will probably be found in the output level adjustment controls or the DC blocking capacitor C1. Excessive output level is an indication of an open resistor or defective oven unit.

b. If the signal voltage measured at the base of Q1 is found to be normal, measure the signal voltages appearing at the collector of Q1 and the emitter of Q2. The AC signal voltages at these points should be in the order of 2.8 volts RMS. If these voltages are found to be normal, connect the high side of the VTVM to terminal 4 (green lead) of transformer T1 and the low side to terminal 1 (black and white lead) of transformer T1. The AC signal voltage should read in the order of 2.8 volts RMS (no load on output). If no signal appears at this point, check DC blocking capacitor C3 and transformer T1 for an open circuit. If the signal voltage measured is low and capacitor C3 is found to be normal, check transformer T1 for shorted turns by measuring the DC resistance of the windings. With the transformer in the circuit (power removed from the unit), the following resistances should be realized; if they are not, replace the transformer.

Terminal 5 to Terminal 8	40-60 ohms
Terminal 1 to Terminal 2	20-30 ohms
Terminal 3 to Terminal 4	20-30 ohms

The above readings are approximate and will vary with individual transformers.

c. Should the signal voltage measured at terminals 1 and 4 of T1 be normal, then capacitor C3 and resistors R8 and R9 should be checked. Contacts of test jack J1 must make a good connection in order for the signal to reach the ring and tip contacts on the terminal board. No signal should appear on the terminal board when a plug is inserted into the test jack.

d. After trouble has been corrected, readjust the COARSE and FINE adjustment controls to the desired output

level. Oven must be at normal operating temperature for this adjustment.

Time Cycle Generator

5.09 Should the time cycle generator unit fail to operate after applying ground to the start (S) terminal, the trouble will most likely be traced to dirty relay contacts. If the unit does not operate after cleaning, the contacts of K1 and K2 and other components such as Q1, C1, CR1, and R1 through R6 should be checked.

5.10 The value of resistor R6 determines the charge time of C1, and the value of resistor R5 determines the discharge time of C1. These values have been selected to provide an operate time of 10 seconds. Any change in the values of C1, R5, or R6 will change the timing of the unit.

6.0 INSTALLATION INSTRUCTIONS

6.01 Before attempting to connect and operate the Model TTS 39BAE Reference Tone Generator, perform a visual inspection of the unit to insure that damage has not been caused during shipment, such as components being pushed together, etc.

6.02 Installers wiring and interconnection are shown on the Installation Diagram, Figure 5.

6.03 Connect a well filtered 48 volt DC source to terminals 1 and 2 of terminal board TB1 located on the rear of the unit. Positive (+) is to be connected to terminal 2 and negative (-) to terminal 1. If polarity is reversed, the unit will not operate, but there will be no damage to any components.

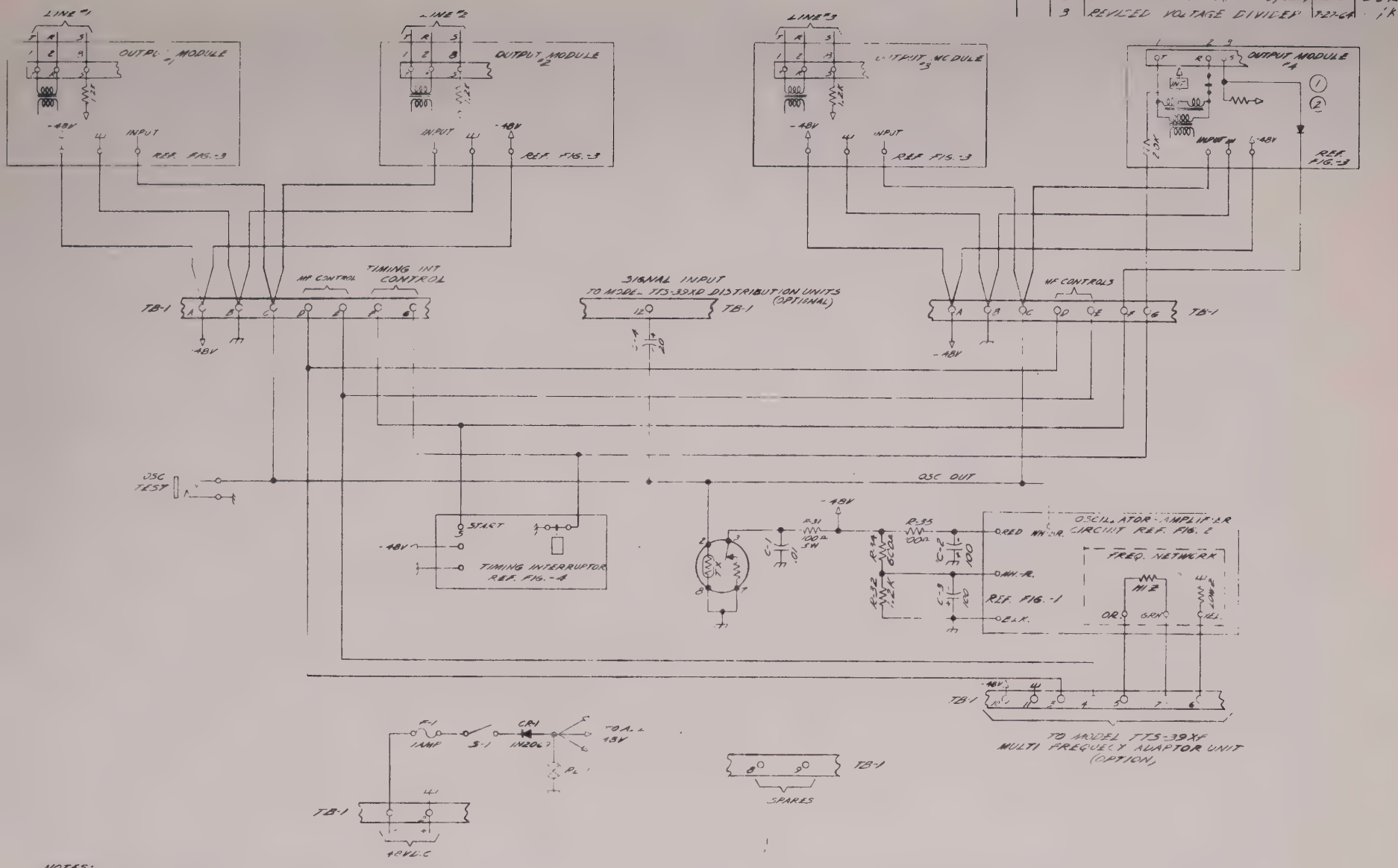
6.04 The unit is designed to operate over a voltage range of 44 to 52 volts at terminals 1 and 2. A direct line to the DC buss should be provided. If this is not feasible, thorough tests must be made to insure that the supply voltage at terminals 1 and 2 will always be within this range regardless of the other loads which may be connected to or disconnected from the common supply line.

6.05 Each of the TTS 39XA Input Amplifier Modules of the TTS 39BAE is normally connected to an especially assigned subscriber number in the dial equipment. The line circuits normally associated with these subscriber appearances must be disconnected. This is necessary to avoid a permanent off hook condition in the line circuit, and to remove all DC voltages from the R-T leads when the TTS 39BAE is in the idle condition.

6.06 The tip, ring, and sleeve of each subscriber number assigned to the TTS 39BAE should be connected to terminals 1, 2, and 8 respectively on each TTS 39XA Output Amplifier Module.

6.07 Each TTS 39XA can be arranged for either 900 or 600 ohm output impedance. Installation Diagram, Figure 5, shows the correct strap to be added or deleted for the 600 or 900 ohm impedance.

6.08 Should the impedance of a TTS 39XA be changed in the field, the level should be readjusted to meet the correct requirements. Before attempting the above level adjustments, it is important to allow a half hour warm up period, as this period of time is required for the temperature controlled oven to reach operating temperature.

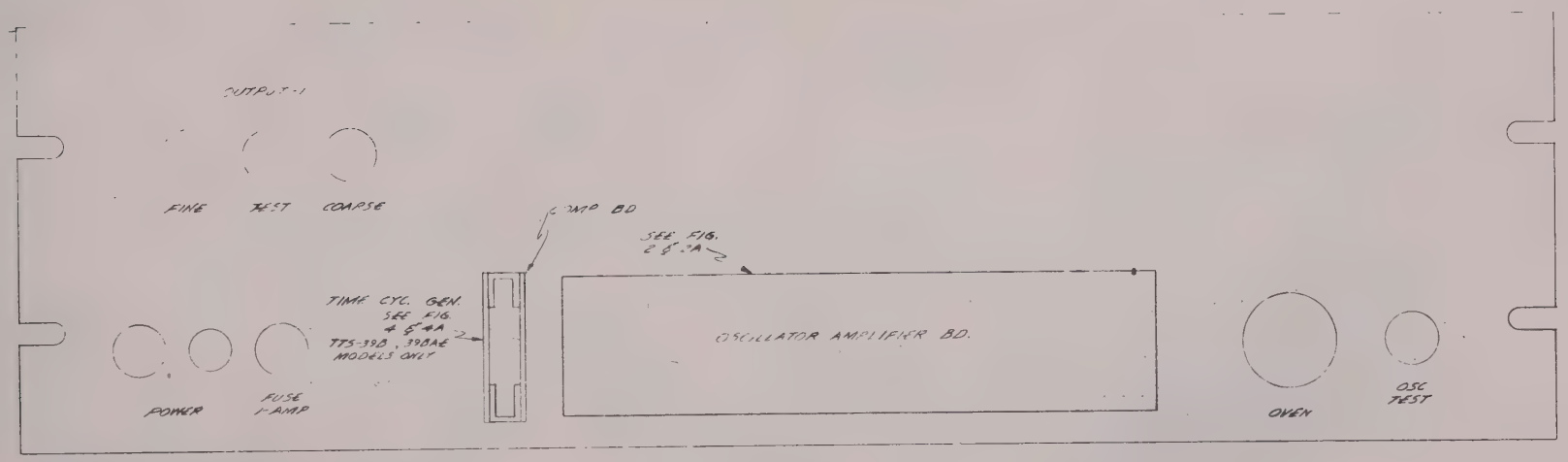


REVISIONS			SIZE	
			CONT ON SHEET	SH NO
ZONE	SYM	DESCRIPTION	DATE	APPROV
	1	MINOR CHANGES & ADDITIONS	3-6-64	L.B.A
	2	CHANGED OUTPUT #4 (MEMO BY MBW)	4-27-64	D.L.R.
	3	REVISED VOLTAGE DIVIDER	9-27-64	J.K.

NOTES:
① CIRCUITRY OF OUTPUT #4 ARRANGED TO PROVIDE TIMED OFF HOOK INTERRUPTIONS TOTAL SLEEVE RESISTANCE TO BATT = 1200Ω

FIG. 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS: ±1/64 DECIMALS: ±.005 ANGLES: ±½° ALL SURFACES √ MATERIAL	DRAWN K.A. SMITH DATE 1-10-64 APPD. ISSUED APPROVED DATE	SCHEMATIC IRC REFERENCE TONE GENERATOR TTS-39A	NORTHEAST ELECTRONICS CO CONCORD, N. H. REF NO. C-1191



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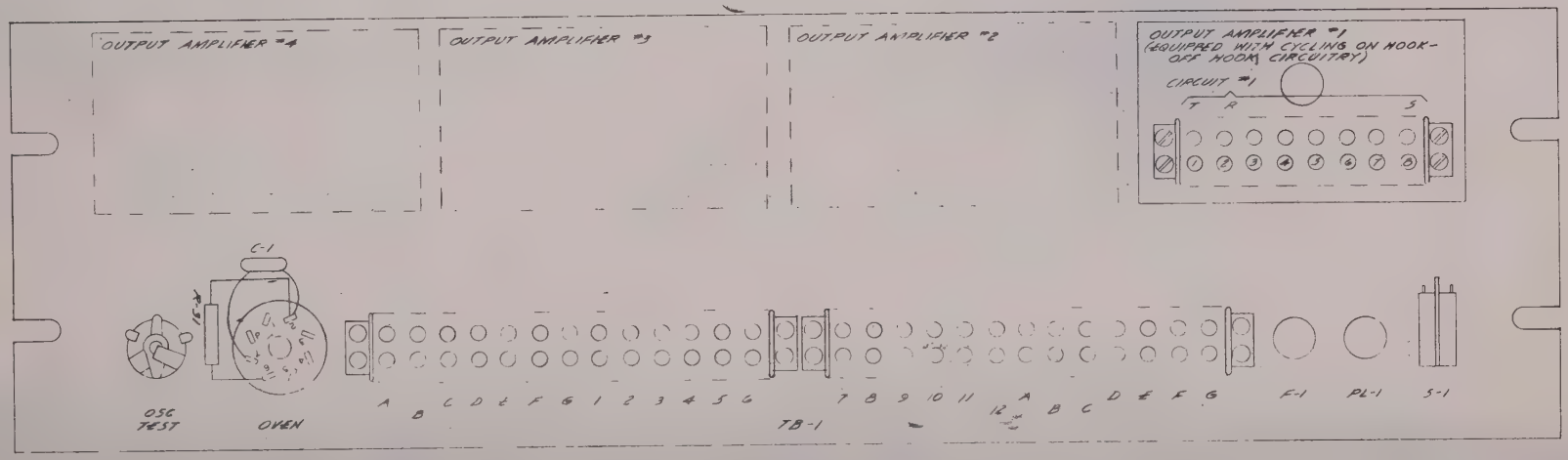
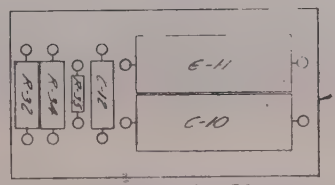


REAR



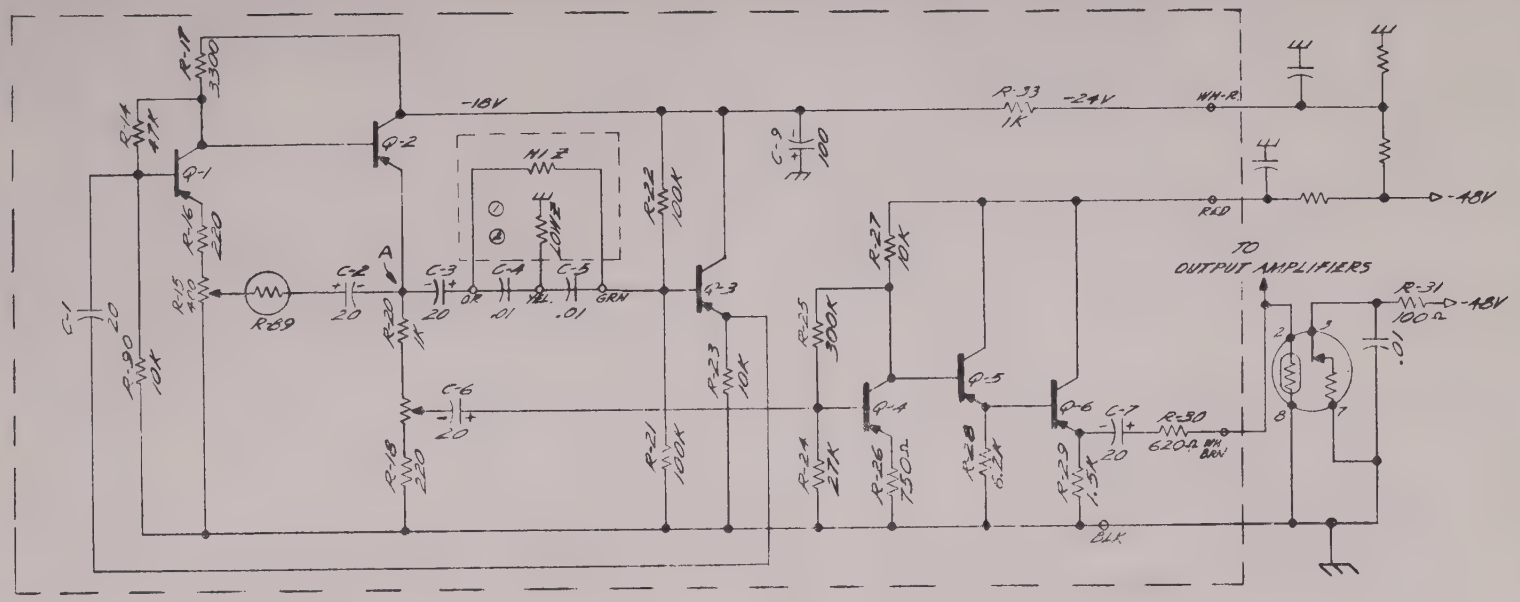
COMPONENT BOARD

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES, TOLERANCES ON FRACTIONS ± 1/64, DECIMALS ± .005, ANGLES ± ½, ALL SURFACES ✓	DRAWN LEO B. GAGNON	PANEL ASSEMBLY	NORTHEAST ELECTRONICS CORP. CONCORD, N. H.
MATERIAL	DATE 11-9-64	TTS-39A TTS-39B TTS-39BAL	REF. NO. C-1191
FINISH	APPD		SIZE C 60719
PAINT	ISSUED		
SCREEN PER	APPROVED / DATE		
	ENGR		
	MFG		
	MATL	SCALE / WT CALC ACTUAL	CONT ON SHEET / SH NO

FIG. 1A

REVISIONS	SIZE	REV
	CONT ON SHEET	SH NO

SYM	DESCRIPTION	DATE	APPROVAL
1	CHANGED VALUES	8-19-64	G.W.S

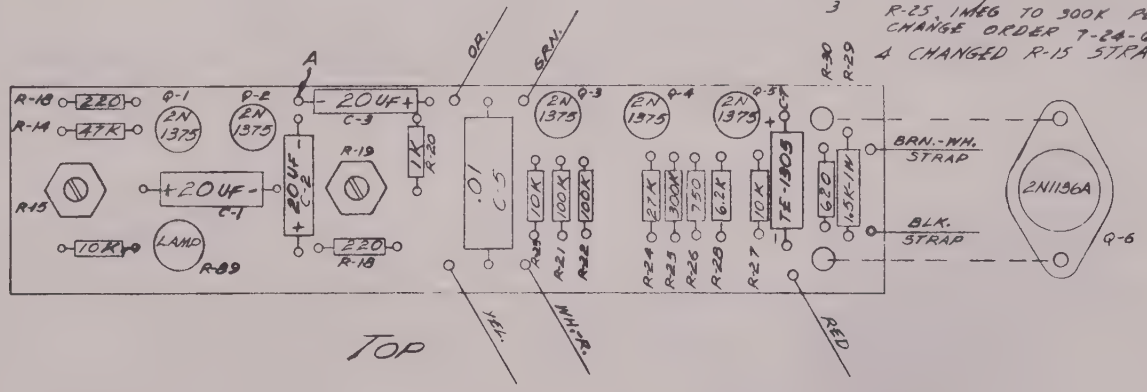


NOTES:
1. SELECTED VALUES TO PROVIDE DESIRED FREQUENCY
2. OMIT FOR MULTI-FREQUENCY OPERATION

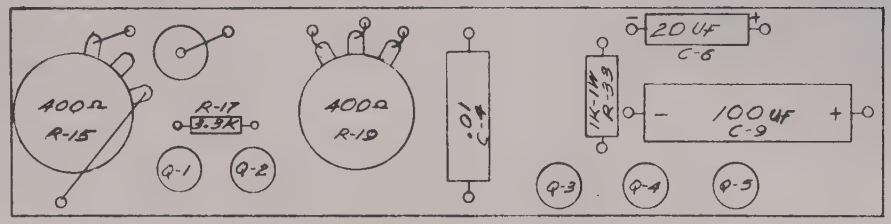
FIG. 2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ±½° ALL SURFACES	DRAWN K.A. SMITH	SCHEMATIC OSCILLATOR AMPLIFIER PRINTED CIRCUIT	NORTHEAST ELECTRONICS CORP. CONCORD, N. H.
MATERIAL	DATE 1-10-64		REF. NO.
	APPD		SIZE B 40477
	ISSUED		
FINISH	APPROVED / DATE		
PAINT	ENGR		
SCREEN PER	MFG		
	MATL	SCALE / WT CALC ACTUAL	CONT ON SHEET / SH NO

REVISIONS				SIZE	REV
				CONT ON SHEET	SH NO.
SYM	DESCRIPTION			DATE	APPROVAL
1	REDRAWN			10/3/62	K.A.S
2	Changed resistor values per change order 1-11-63			9-4-63	
3	R-25, 1MEG TO 300K PER CHANGE ORDER 7-24-64			8-17-64	L.B.G.
4	CHANGED R-15 STRAPPING			9-10-64	



TOP



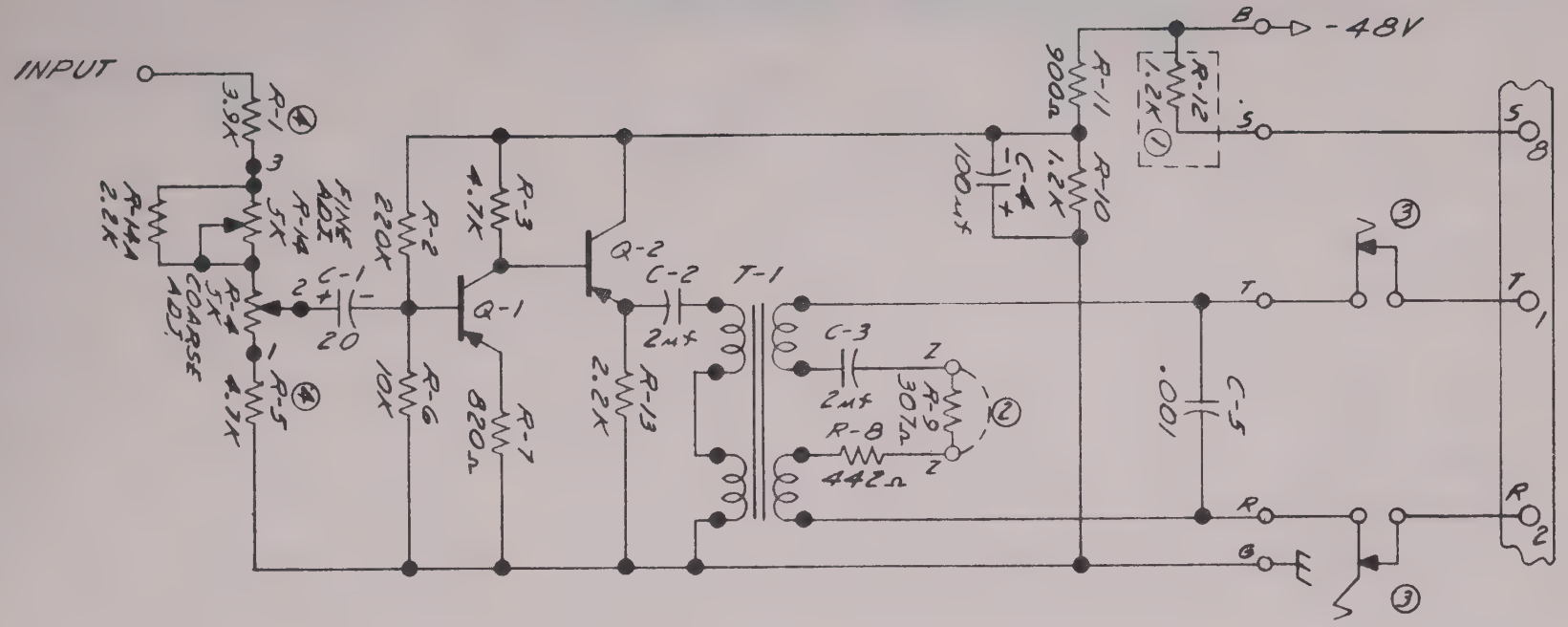
BOTTOM

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 1/2° ALL SURFACES ✓	DRAWN L.B. GAGNON	ASSEMBLY TOP P.C. BOARD TTS-95 AND TTS-39	Northeast Electronics Corp. Concord, N. H.
	DATE 5-2-61		REF. B-1117
	APPD		SIZE B 40130
	ISSUED		
MATERIAL	APPROVED / DATE		
	ENGR		
FINISH	MFG		
	MATL		
	SCALE	WT CALC ACTUAL	CONT ON SHEET SH NO.

FIG. 2A

NOTES:

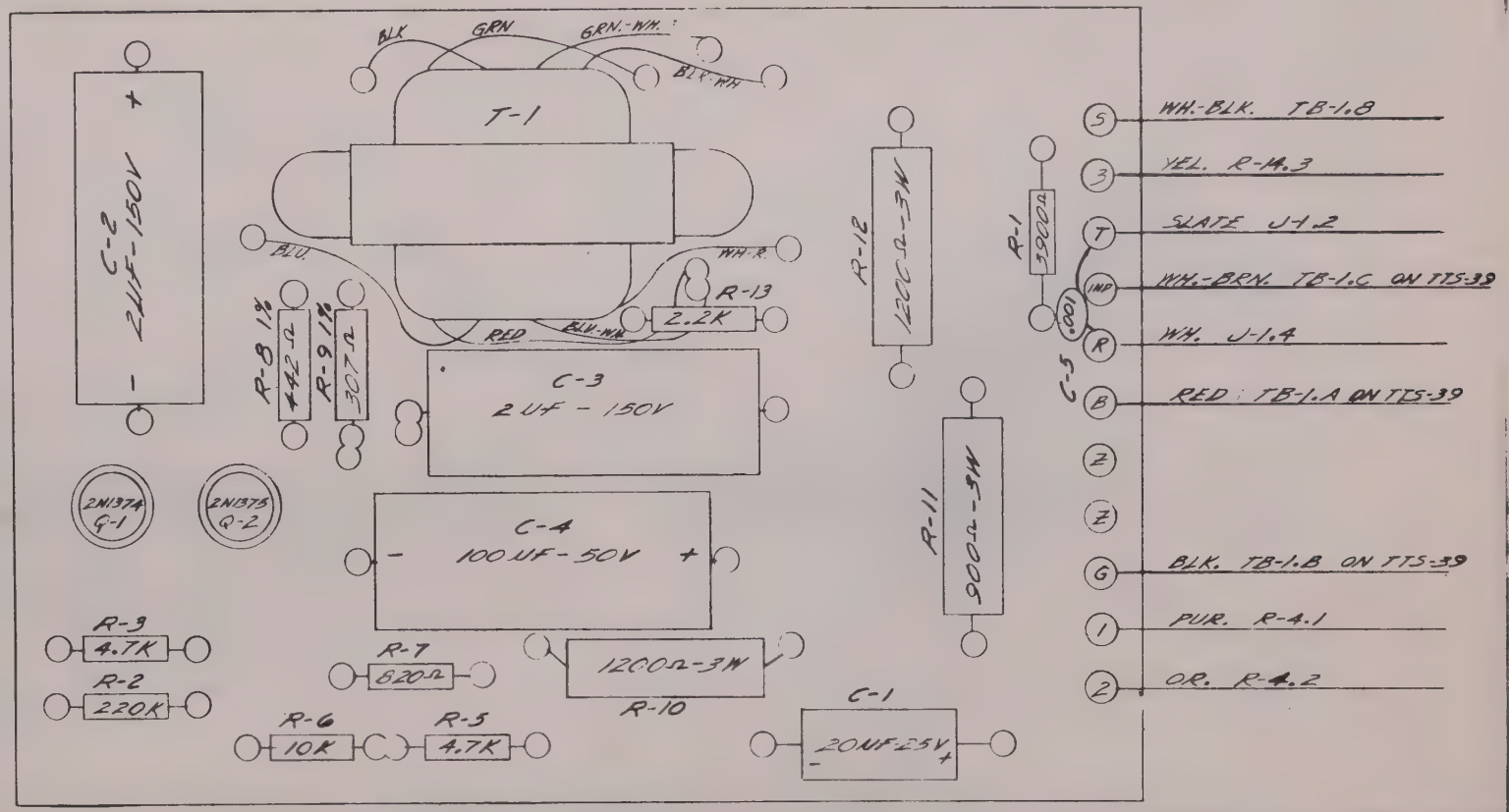
1. SLEEVE RESISTANCE NORMALLY SUPPLIED = 1200Ω.
2. INSERT STRAP FOR 600Ω, REMOVE FOR 900Ω.
3. TEST JACK.
4. VALUE SELECTED TO PROVIDE DESIRED OUTPUT RANGE.



AMPLIFIER
MODEL TTS-39XA

A-10648
FIG. 3

REVISIONS				SIZE / CONT ON SHEET / SH NO / REV
SYM	DESCRIPTION	DATE	APPROVAL	
1	CAP. ADDED PER. A1191-C01	7-28-64	KAS	

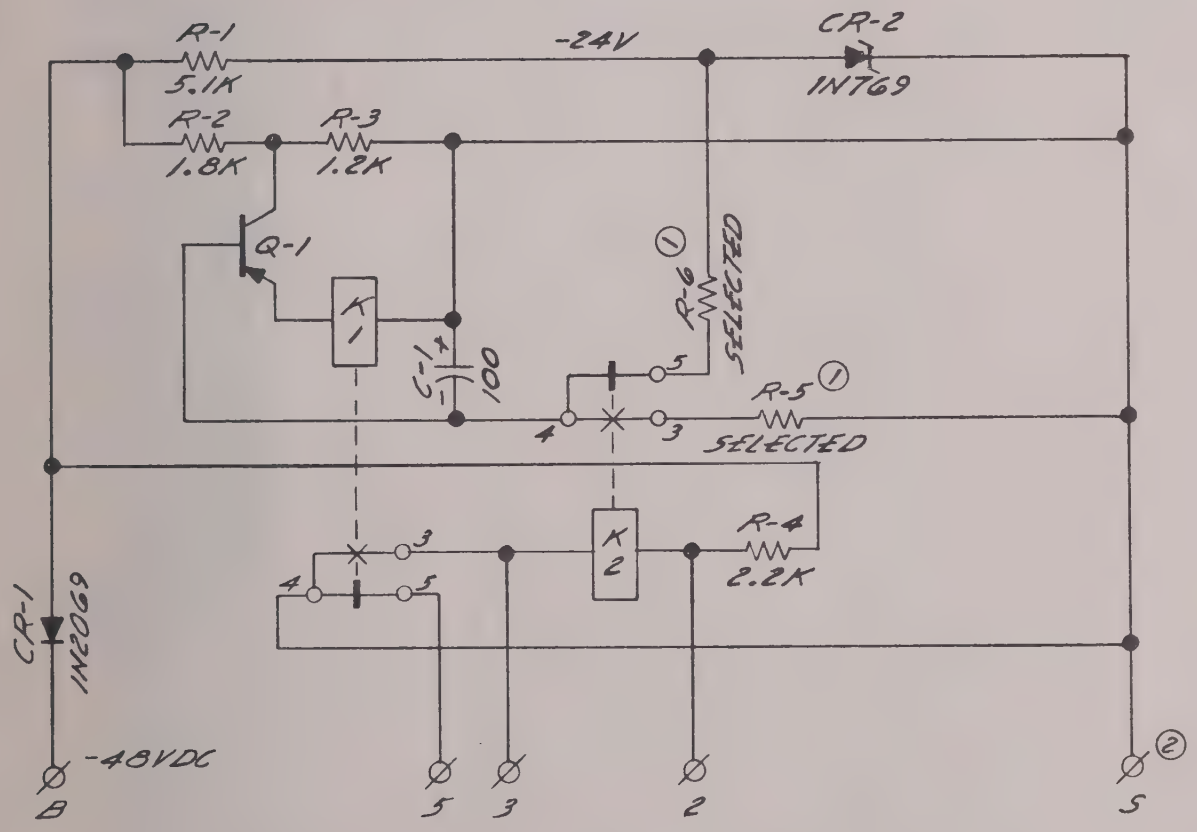


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ✓ ±½° ALL SURFACES	DRAWN K. A. SMITH	A'SS'Y & WIRING P.C. BD.	NORTHEAST ELECTRONICS CORP. CONCORD, N. H.
MATERIAL	DATE 6-23-64	TIS-39XA	REF. NO. B-1191
	APPD.		SIZE B 40601
FINISH	ISSUED.		
PAINT	APPROVED / DATE		
SCREEN PER	ENGR.		
	MFG.		
	MATL.	SCALE / WT CALC ACTUAL	CONT ON SHEET / SH NO

FIG. 3A

NOTE:

① SELECTED TO PROVIDE DESIRED TIMING.
② TO START APPLY GROUND TO TERM. "S"



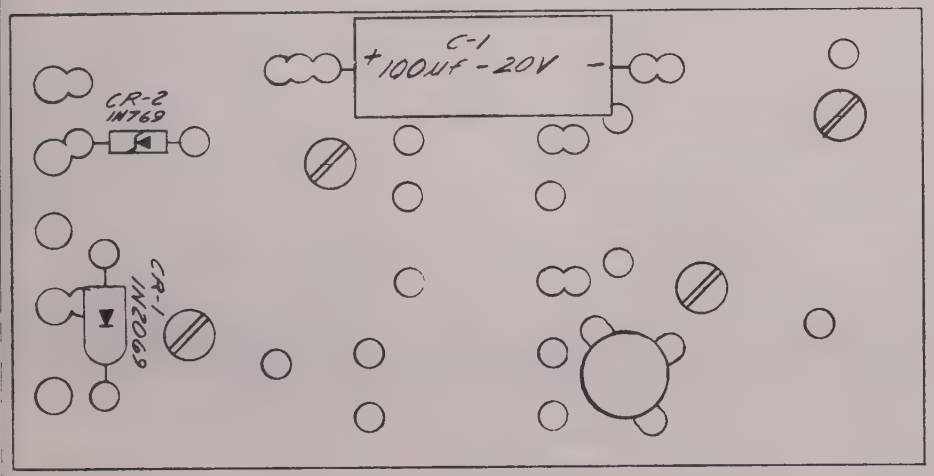
SCHEMATIC
TIME CYCLE GENERATOR

FIG.-4
A-10635

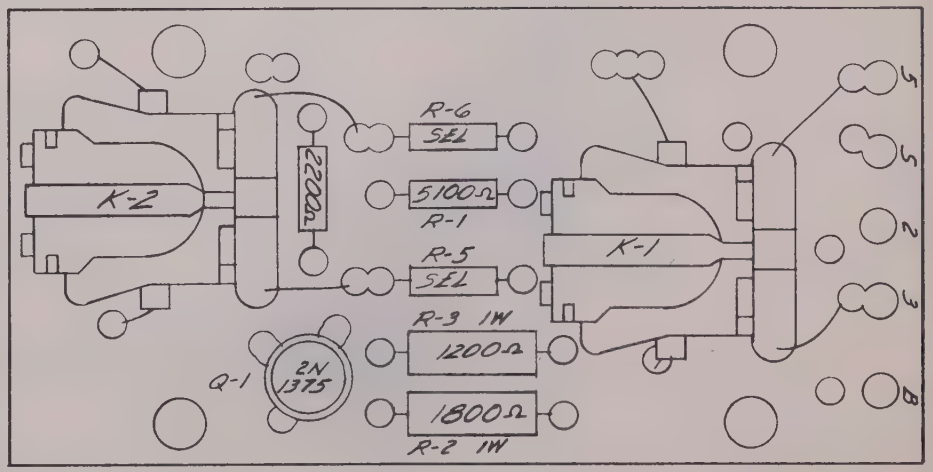
REV	SIZE	CONT ON SHEET	SH NO

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL



REAR VIEW



FRONT VIEW

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ±½° ALL SURFACES MATERIAL FINISH PAINT SCREEN PER	DRAWN K.A. SMITH DATE 10-21-64 APPD ISSUED APPROVED / DATE ENGR MFG MATL	ASSEMBLY P.C. BOARD TIME CYCLE GEN. SCALE WT CALC ACTUAL	NORTHEAST ELECTRONICS CORP. CONCORD, N. H. REF. NO. B-1198 SIZE B 40690 CONT ON SHEET SH NO

FIG. 4A

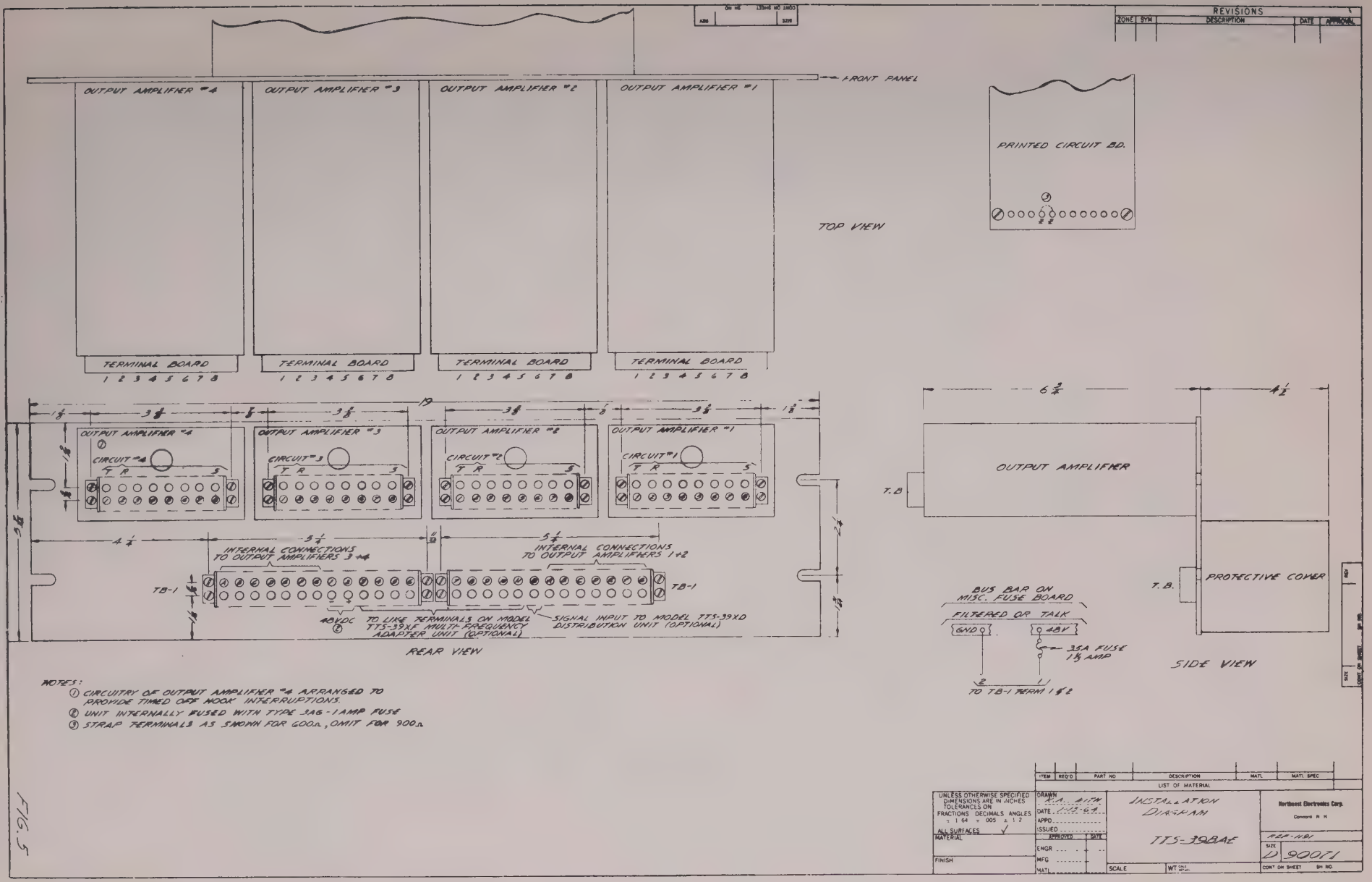

REVISIONS
ZONE | SYM | DESCRIPTION | DATE | APPROVAL
FRONT PANEL
OUTPUT AMPLIFIER "4
OUTPUT AMPLIFIER "3
OUTPUT AMPLIFIER "2
OUTPUT AMPLIFIER "1
TERMINAL BOARD
1 2 3 4 5 6 7 8
TOP VIEW
PRINTED CIRCUIT BD.
CIRCUIT "4
CIRCUIT "3
CIRCUIT "2
CIRCUIT "1
T R S
INTERNAL CONNECTIONS TO OUTPUT AMPLIFIERS 3 & 4
INTERNAL CONNECTIONS TO OUTPUT AMPLIFIERS 1 & 2
TB-1
40 VDC
TO LIKE TERMINALS ON MODEL TTS-39XE MULTI-FREQUENCY ADAPTER UNIT (OPTIONAL)
SIGNAL INPUT TO MODEL TTS-39XD DISTRIBUTION UNIT (OPTIONAL)
REAR VIEW
OUTPUT AMPLIFIER
T.B.
PROTECTIVE COVER
SIDE VIEW
BUS BAR ON MISC. FUSE BOARD
FILTERED QR TALK
GND
48V
3.5A FUSE 1⅛ AMP
TO TB-1 TERM 1 & 2
NOTES:
① CIRCUITRY OF OUTPUT AMPLIFIER "4 ARRANGED TO PROVIDE TIMED OFF HOOK INTERRUPTIONS.
② UNIT INTERNALLY FUSED WITH TYPE 3AG-1 AMP FUSE
③ STRAP TERMINALS AS SHOWN FOR 600Ω, OMIT FOR 900Ω
ITEM | REQ'D | PART NO | DESCRIPTION | MATL | MATL SPEC
LIST OF MATERIAL
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ± 1/64 ± .005 ± 1°
ALL SURFACES
MATERIAL
FINISH
DRAWN
DATE
APPD.
ISSUED
APPROVED | DATE
ENGR
MFG
MATL
INSTALLATION DIAGRAM
TTS-39BAE
Northeast Electronics Corp.
Concord N H
SCALE
WT
SIZE D
90071
CONT ON SHEET
SH NO.

FIG. 5

TABLE OF REPLACEABLE PARTS

Circuit Ref	Description	Mfr* & Mfr's Designation
	Overall Parts	
R31	Resistor: fixed, wirewound, 100 ohms ±5%, 5 w	Q, 243E1015
R32	Resistor: fixed, wirewound, 1.2 K, 3 w	M, PW-3
R34	Resistor: fixed, wirewound, 600 ohms ±10%, 3 w	M, PW-3
R35	Resistor: fixed, composition, 100 ohms ±10%, ½ w	A
C1	Capacitor: fixed, disc, .01 mfd, 600 vdc	F, 1D-.01
C2	Capacitor: fixed, electrolytic, 100 mfd, 50 vdc	Q, TVA-1310
C3	Capacitor: fixed, electrolytic, 100 mfd, 50 vdc	Q, TVA-1310
C4	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	L, APD-046
CR1	Diode: silicon	S, 1N2069
Tx	Thermistor	W, 32A3
	Oven: 24V-55° Thermistor Unit (Special)	O, SA2C-48
S1	Switch: (ON-OFF) SPST	B, 81015-BP
J1	Jack: (OSC TEST)	R, L12B
TB1	Terminal Strip: 2 - 13 position	G, 13-140 3/4w
PL1	Pilot Light Assembly	J, 105-4428-722
	Lamp: 48 volt	J, 60A
	Fuse: 1 Amp	N, 3AG-1A
	Fuse Holder	E, HKP
	Time Cycle Generator	
R1	Resistor: fixed, composition, 5.1 K ±5%, ½ w	A
R2	Resistor: fixed, composition, 1.8 K ±5%, 1 w	A
R3	Resistor: fixed, composition, 1.2 K ±10%, 1 w	A
R4	Resistor: fixed, composition, 2.2 K ±5%, ½ w	A
R5	Resistor: selected value	
R6	Resistor: selected value	
C1	Capacitor: fixed, electrolytic, 100 mfd, 20 vdc	L, APD-095
CR1	Diode: silicon	S, 1N2069
CR2	Diode: regulator, silicon	U, 1N769
Q1	Transistor	T, 2N1375
K1	Relay: 2500 ohm coil	P, RS5D
K2	Relay: 2500 ohm coil	P, RS5D

TABLE OF REPLACEABLE PARTS

Oscillator Board

Circuit Ref	Description	Mfr* & Mfr's Designation
R14	Resistor: fixed, composition, 47 K ±10%, ½ w	A
R15	Resistor: variable, 400 ohms	H, CM22425
R16	Resistor: fixed, composition, 220 ohms ±10%, ½ w	A
R17	Resistor: fixed, composition, 3.3 K ±10%, ½ w	A
R18	Resistor: fixed, composition, 220 ohms ±10%, ½ w	A
R19	Resistor: variable, 400 ohms	H, CM22425
R20	Resistor: fixed, composition, 1 K ±10%, ½ w	A
R21	Resistor: fixed, composition, 100 K ±10%, ½ w	A
R22	Resistor: fixed, composition, 100 k ±10%, ½ w	A
R23	Resistor: fixed, composition, 10 K ±10%, ½ w	A
R24	Resistor: fixed, composition, 27 K ±10%, ½ w	A
R25	Resistor: fixed, composition, 300 K ±5%, ½ w	A
R26	Resistor: fixed, composition, 750 ohms ±5%, ½ w	A
R27	Resistor: fixed, composition, 10 K ±10%, ½ w	A
R28	Resistor: fixed, composition, 6.2 K ±5%, ½ w	A
R29	Resistor: fixed, composition, 1.5 K ±10%, 1 w	A
R30	Resistor: fixed, composition, 620 ohms ±5%, ½ w	A
R33	Resistor: fixed, composition, 1 K ±10%, 1 w	A
R89	Lamp: tungsten, 4 w, 120 volt	K, T4-1/2
R90	Resistor: fixed, composition, 10 K ±10%, ½ w	A
C1	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	L, APD-046
C2	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	L, APD-046
C3	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	L, APD-046
C4	Capacitor: fixed, paper, .0096 mfd, 100 vdc	Q, 194P96251
C5	Capacitor: fixed, paper, .0096 mfd, 100 vdc	Q, 194P96251
C6	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	L, APD-046
C7	Capacitor: fixed, electrolytic, 20 mfd, 50 vdc	Q, TE-1305
C9	Capacitor: fixed, electrolytic, 100 mfd, 50 vdc,	L, APD-127
Q1-thru Q5	Transistors	T, 2N1375
Q6	Power Transistor	D, 2N1136A

Output Modules 1, 2, 3, 4 - Model A

R1	Resistor: fixed, composition, 3.9 K ±5%, ½ w	A
R2	Resistor: fixed, composition, 4.7 K ±5%, ½ w	A
R3	Resistor: fixed, composition, 220 K ±10%, ½ w	A
R4	Resistor: variable, 5 K	H, CM29064NP
R5	Resistor: fixed, composition, 4.7 K ±5%, ½ w	A
R6	Resistor: fixed, composition, 10 K ±5%, ½ w	A
R7	Resistor: fixed, composition, 820 ohms ±10%, ½ w	A
R8	Resistor: fixed, composition, 442 ohms ±1%, ½ w	M, CEC-TO
R9	Resistor: fixed, composition, 307 ohms ±1%, ½ w	M, CEC-TO
R10	Resistor: fixed, wirewound, 1.2 K ±10%, 3 w	M, PW-3
R11	Resistor: fixed, wirewound, 900 ohms ±10%, 3 w	M, PW-3
R12	Resistor: fixed, wirewound, 1.2 K ±10%, 3 w	M, PW-3

TABLE OF REPLACEABLE PARTS

Circuit Ref	Description	Mfr* & Mfr's Designation
	Output Modules 1, 2, 3, 4 - Model A, Cont.	
R13	Resistor: fixed, composition, 2.2 K ±5%, ½ w	A
R17	Resistor: variable, 5 K	H, CM29064NP
R17A	Resistor: fixed, composition, 2.2 K ±5%, ½ w	A
C1	Capacitor: fixed, electrolytic, 20 mfd, 25 vdc	L, APD-046
C2	Capacitor: fixed, paper, 2.0 mfd 150 vdc	Q, 121P20591R5S4
C3	Capacitor: fixed, paper, 2.0 mfd, 150 vdc	Q, 121P20591R5S4
C4	Capacitor: fixed, electrolytic, 100 mfd, 50 vdc	L, APD-127
C5	Capacitor: fixed, disc, .001 mfd, 600 vdc	F, DD-102
Q1	Transistor	T, 2N1374
Q2	Transistor	T, 2N1375
T1	Transformer: Line to Line	V, S-58X
J1	Output Jack	R, 54-SF
TB1	Terminal Strip	G, 8-140 3/4w
	Components listed below used on Output Module 4 Only:	
R18	Resistor: fixed, composition, 4.7 K ±5%, ½ w	A
L1	Inductor	O, TN1274
K1	Relay: 2500 ohm coil	P, RS5D
CR1	Diode: silicon	S, 1N2069

*See List of Manufacturers Code Letters for Replaceable Parts Table

LIST OF MANUFACTURERS CODE LETTERS

Code Letter	Manufacturer
A	Allen-Bradley Company
B	Arrow-Hart and Hageman Electric Company
C	Automatic Electric Company
D	Bendix Corporation
E	Bussman Manufacturing
F	Centralab Electronics
G	Cinch Manufacturing Company
H	Clarostat Manufacturing Company
J	Dialight Corporation
K	Herzog Miniature Lamp Works, Inc.
L	International Electronic Industries
M	IRC, Inc.
N	Littelfuse, Inc.
O	Northeast Electronics Corporation
P	Potter and Brumfield
Q	Sprague Electric Company
R	Switchcraft, Inc.
S	Sylvania Electric Products, Inc.
T	Texas Instruments, Inc.
U	Transitron Electronic Corporation
V	Triad Transformer Corporation
W	Victory Engineering Corporation